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ABSTRACT

Presents a report on the first phase of a large scale meta-analysis of the field of science education in which the major research questions pursued in the extant science education research literature were identified and organized to provide a conceptual framework for meta-analysis. The six major research questions identified from this project are listed. (CS)

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THE MAJOR QUESTIONS ADDRESSED BY THE EXTANT SCIENCE EDUCATION RESEARCH: A MAP FOR META-ANALYSIS

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The Major Questions Addressed by the Extant Science Education Research: A Map for Meta-Analysis

The recent appearance of meta-analysis (Glass, 1976)[1] has provided a useful tool for integrating and interpreting the results of science education research. Its applicability to an increasingly large set of research topics is well documented (Glass, et.al. 1980)[2]. While this technique is being applied to a variety of specific science education research questions, it has the potential to provide even more information if applied to the totality of extant science education research. Such an approach is possible if the integrative review of research focuses upon the major research questions in the field, gives appropriate attention to the various subquestions subsumed under each major question, and provides for integration of data on the variables that pertain to two or more of these major questions. Within such a conceptual framework, and given sufficient resources, it would be possible to integrate the results of numerous research studies and provide a compendium of interpretative and integrative statements about the major questions addressed by the extant body of science education research literature.

Such an endeavor is in fact underway with financial support from the National Science Foundation; the research reported herein is work already completed on this project to identify the major questions in the field of science education which should be subjected to meta-analysis. This analysis of the science education literature is of value for the project cited above, as well as for other researchers, in that it provides a "map" of the major questions addressed by past research and the many variables that are of potential interest to other persons conducting meta-analyses in science education.

This analysis of the major research questions and the variables involved was conducted by a combination of (1) empirical analysis of the extant research, and (2) expert judgment as to the importance of particular questions. Major

attention was given to the empirical analysis rather than the expert judgment, however, in that the overall approach was more inclusive than exclusive. In other words, for purposes of conducting a large-scale meta-analysis of the totality of science education research, major attention was given to including whatever empirical analysis showed to be the subject of a substantial number of research investigations. There was little need for using expert judgment to exclude large areas in the interest of making the results of manageable size.

The first step in this endeavor was to collect and examine a representative sample of science education research studies. Literature was sampled across time and type of publication and included studies from The Journal of Research in Science Teaching, Science Education, Dissertation Abstracts, and the most recent abstracts of presentations for the National Association for Research in Science Teaching annual convention. About 300 such research articles were sampled, and the major (as well as subsidiary) questions addressed were recorded.

The questions collected were then classified into some broad, general categories. Five persons classified separate portions of the questions into categories. These categories, developed independently by each of the five persons, had much in common. The entire group of five then examined the questions and oragnized them into a classification system. This system also was very similar to the previously identified categories. It resulted in thirteen general areas encompassing all but a small percentage of studies which neither fit within these thirteen categories nor constituted a meaningful grouping themselves.

The researchers then went back to the literature (including the Curtis digests of Research in Science Education of several decades ago) to see if additional research questions fit within the framework that had been empirically derived. This cross-validation indicated the categories were appropriate.

The next step was to develop a full description of each of these thirteen areas. They were identified by a generic question for each area along with sample

subquestions. These sample subquestions were examples of a larger set of sub-questions which could be listed under each generic question. They were a representative and not exhaustive set of such questions. In addition, definitions of terms, descriptions of some variables, and a limited rationale for considering the questions were provided.

A form was then developed on which responses could be obtained from other science education researchers concerning these categories. Twenty people were mailed a full description of the thirteen areas, a response form, and a cover letter requesting that they be prepared to discuss the material by phone. All twenty people responded to a telephone request for their judgments on the relative importance of these questions and the adequacy of the literature for doing a meta-analysis. While these judgments of the relative importance of the questions were of value, the judgments of the adequacy of the literature were largely subordinated by an empirical search of the total science education research.

Literature searches were conducted on a sampling basis to obtain an estimate of the size of the literature and determine if sufficient studies existed for a meta-analysis of each question. Abbreviated computer searches were conducted using data bases such as ERIC, Dissertation Abstracts, and Social Science Research. The citations obtained then were screened to eliminate those items which were not research publications. Subsequent investigation indicated some problems with the manner in which the computer searches had been conducted, so additional searches were done "by hand" as a check. They were done on a sampling basis using selected annual reviews of science education research and Science Education - A Dissertation Bibliography[3], a listing of all doctoral dissertations pertaining to science education conducted between 1950 and 1977. These procedures provided an estimate of the size of the literature pertaining to each of the thirteen questions.

A two-day conference of five leading science educators from across the country was then convened to confer with the project staff and produce a

final classification of research questions for meta-analysis as well as identify important variables to include when integrating the research for each question.

One of the original questions ("What are the goals and priorities of science education?") was eliminated due to an insufficient number of empirical studies, even though it was ranked high in importance. The other twelve questions were recombined into a somewhat different pattern which is outlined in broad terms as follows:

I. What are the effects of different curricular programs in science?

II. What are the effects of different instructional systems used in science teaching (e.g. programmed instruction, mastery learning, departmentalized instruction)?

III. What are the effects of different teaching techniques (e.g. questioning behaviors, wait-time, advanced organizers, testing practices)?

IV. What are the effects of different pre-service and in-service teacher education programs and techniques?

V. What are the relationships between science teacher characteristics and teacher behaviors or student outcomes?

VI. What are the relationships between student characteristics and student outcomes in science?

It is estimated that each of these six topics will require between five and nine person-months to meta-analyze, not counting prior thorough centralized searching of the literature and additional analyses of the data to investigate topics related to variables which cut across two or more of the six topics.

Bibliography

1. Glass, Gene V, "Primary, Secondary, and Meta-Analysis of Research", Educational Researcher, 5 (10), 3-8 November, 1976.

2. Glass, Gene V; McGaw, B.; White, K.R.; and Smith, M.L., Integration of Research Studies: Meta-Analysis of Research, Boulder, Colorado: Laboratory of Educational Research, University of Colorado, 1980, 350 pp.

3. University Microfilms International, Science Education - A Dissertation Bibliography, Dissertation Publishing, University Microfilms International, Ann Arbor, Michigan, 1978.